Rivanna River TAC Meeting #2
June 6, 2007

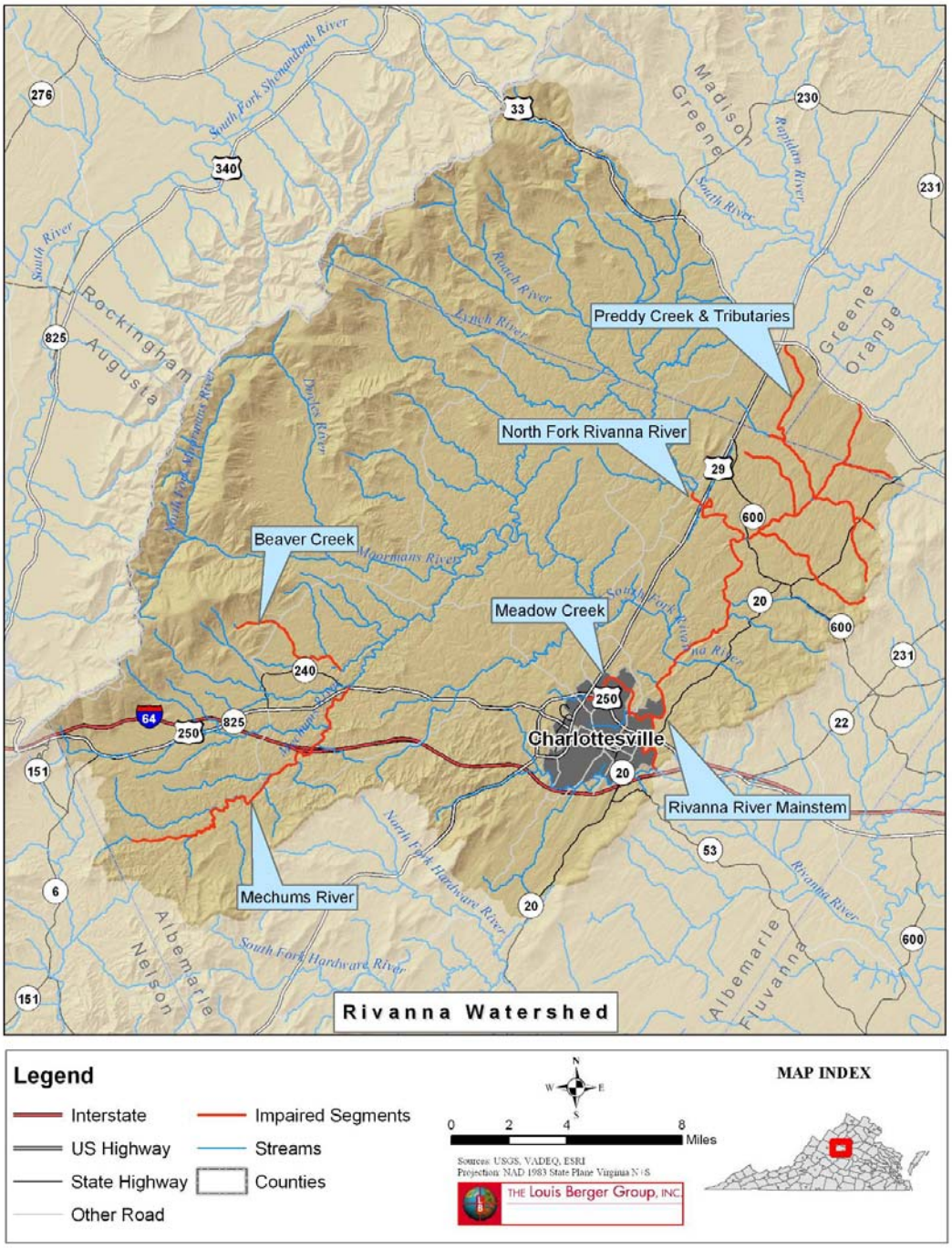
1. Description of impairments and exceedance rates

TMDLs are being developed for Virginia DEQ impaired segments within the Rivanna River Watershed:

- 6 segments are impaired due to violations of the bacteria recreation standards

Fecal Coliform Data Collected at DEQ Listing Stations										
Impaired Stream	**Extent**	**Station ID**	**Samples**	**Date sampled**		**Values**			**Instantaneous Exceed.**	
				First	**Last**	**Min**	**Max**	**Av**	**Sum**	**%**
Beaver Creek	Headwaters to Beaver Creek Reservoir	2-BVR005.70	18	11/29/1994	5/16/2001	100	4000	400	2	11%
Mechums River	Lickinghole Creek to Moormans River	2-MCM005.12	155	1/3/1990	10/3/2006	100	8000	364	27	17%
Meadow Creek	Headwaters to Rivanna River	2-MWC000.60	42	8/5/1991	6/26/2001	100	8000	1119	15	36%
Preddy Creek	Headwaters to NF Rivanna River	2-PRD004.42	1	4/5/2006	4/5/2006	25	25	25	0	0%
North Fork Rivanna River	Public water intake to Rivanna River	2-RRN002.19	82	1/3/1990	7/17/2006	25	8000	386	13	16%
Rivanna River	NF Rivanna confluence to Moores Creek	2-RVN037.54	35	8/18/1993	6/26/2001	100	5600	423	8	23%

E.Coli Data Collected at DEQ Listing Stations										
Impaired Stream	**Extent**	**Station ID**	**Samples**	**Date sampled**		**Values**			**Instantaneous Exceed.**	
				First	**Last**	**Min**	**Max**	**Av**	**Sum**	**%**
Beaver Creek	Headwaters to Beaver Creek Reservoir	2-BVR002.19	7	4/13/2004	9/7/2005	25	280	61	1	14%
Mechums River	Lickinghole Creek to Moormans River	2-MCM005.12	39	8/8/2002	10/3/2006	10	2000	172	5	13%
Meadow Creek	Headwaters to Rivanna River	2-MWC000.60	12	7/7/2003	5/2/2005	25	2000	434	4	33%
Preddy Creek	Headwaters to NF Rivanna River	2-PRD000.21	12	7/7/2003	5/2/2005	25	700	157	3	25%
Preddy Creek	Headwaters to NF Rivanna River	2-PRD004.42	13	7/7/2003	4/5/2006	25	250	98	1	8%
North Fork Rivanna River	Public water intake to Rivanna River	2-RRN002.19	19	7/7/2003	7/17/2006	25	1200	167	5	26%
Rivanna River	NF Rivanna confluence to Moores Creek	2-RVN037.54	12	7/7/2003	5/2/2005	25	1500	205	2	17%



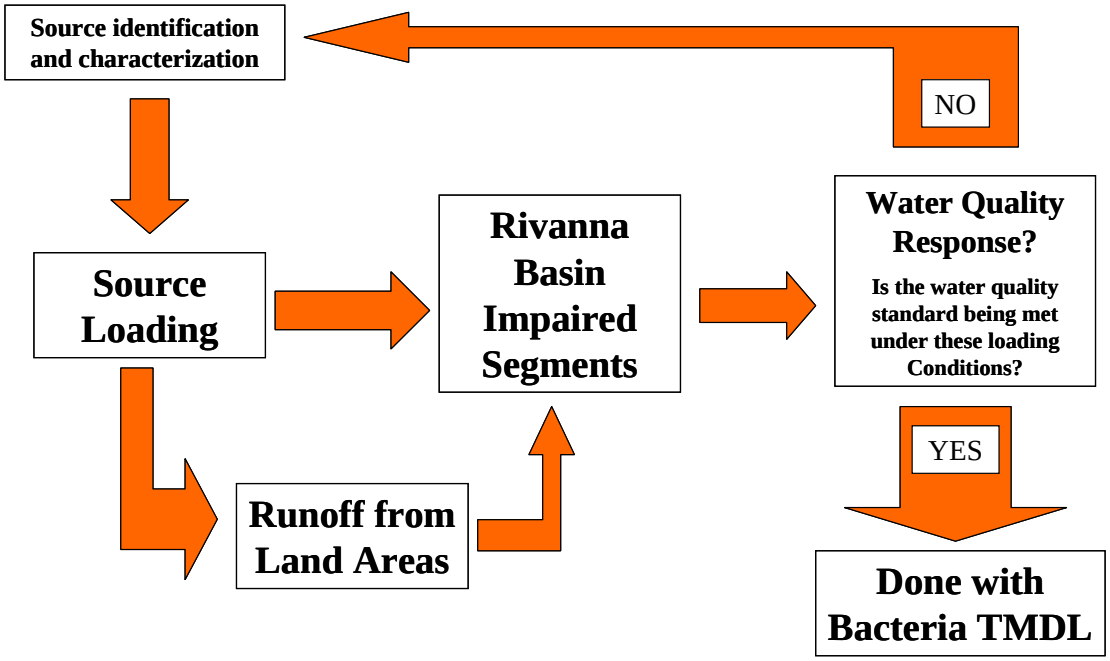
Discussion Questions:

1. Do you have any questions about where the impairments are?

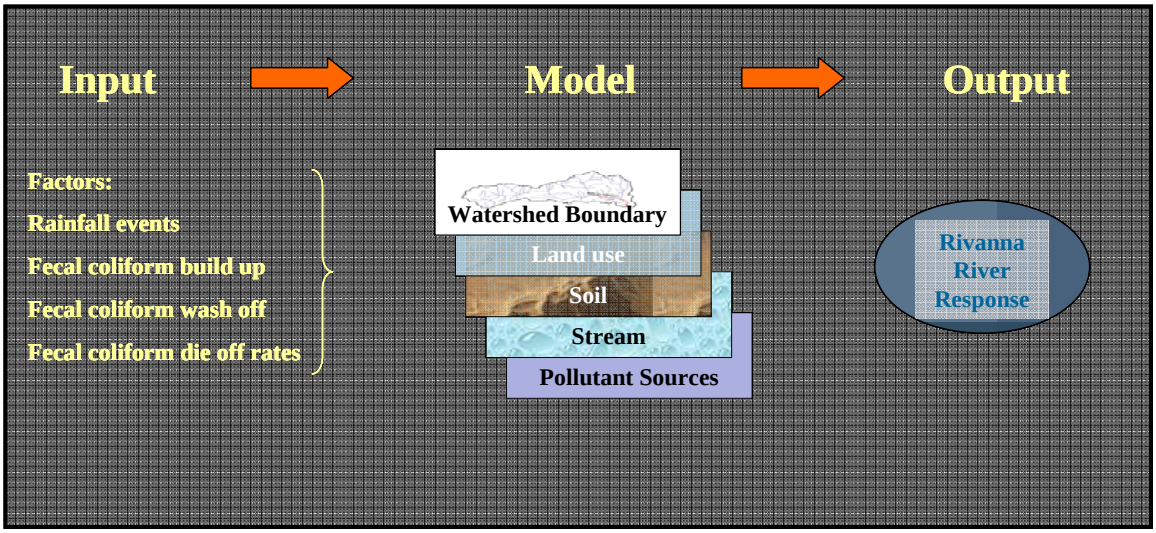
2. Are these violation rates surprising to you? Why or why not?

2. Linking Sources to Water Quality

What is the TMDL Process?



How does the Hydrologic Simulation Program Fortran Model Work?



Discussion Questions:

1. Do you have any questions on how this model works?

3. What types of data go into the model?

- Watershed physiographic data (elevation, land use, soils)
- Hydrographic data
- Weather data
- Point sources and direct discharge data and information
- Environmental monitoring data
- Stream flow data

4. Bacteria sources characterization data

- Addresses the following issues related to bacteria production:
- Fecal Coliform loading from Human Sources
  - Straight pipes
  - Septic systems
  - Biosolids
- Fecal Coliform loading from Livestock
  - Livestock inventory
  - Livestock grazing and stream access
  - Confined animal facilities
  - Manure management
- Fecal coliform loading from Wildlife
  - Wildlife Inventories
- Fecal Coliform loading from Pets
  - Pet Inventories
- Best management practices (BMPs)

Discussion Questions:

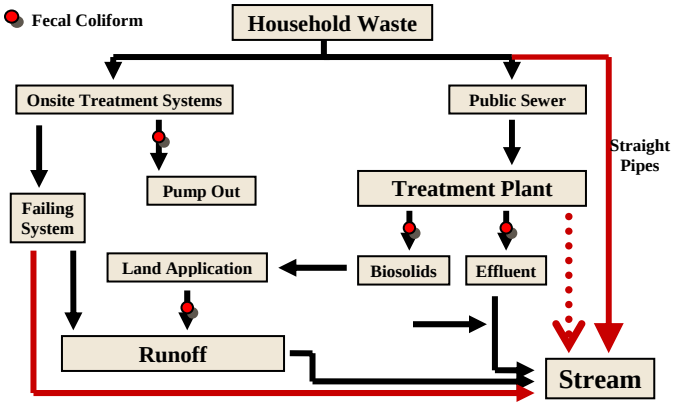
1. Can you think of any other factors that we should consider?

5. Preliminary summary of the overall source numbers

5.1 Fecal Coliform loading from Human Sources

Population Data: Based on 2004 United States Census Data

- Population in the Rivanna River Watershed is approximately **98,790** people
- There are approximately **36,603** households within the Rivanna River Watershed
- Sewage Disposal Methods
  - Sewer Systems (predominantly cities)
  - Septic Systems
  - Other Systems (assumed to be no waste management, or "straight pipe")



- Septic systems failure rates can range between 3 and 40%.
- Failing septic systems and straight pipes near stream channels can contribute significant sewage to the watershed streams.
  - An estimated **25** septic systems within 200 ft of a stream are failing in the Rivanna River Watershed (based on a 3% failure rate)
  - Within a 200 ft of a stream, there are approximately **39** straight pipes discharging to the stream.

Failing Septic Systems & Straight Pipes by Impairment Watershed

Impairment Watershed	Failing Septic	Straight Pipes
Beaver Creek	1	2
Meadow Creek	1	1
Mechums River	2	2
NF Rivanna	10	19
Preddy Creek	1	3
Rivanna Mainstem	23	36

Point Source Data:

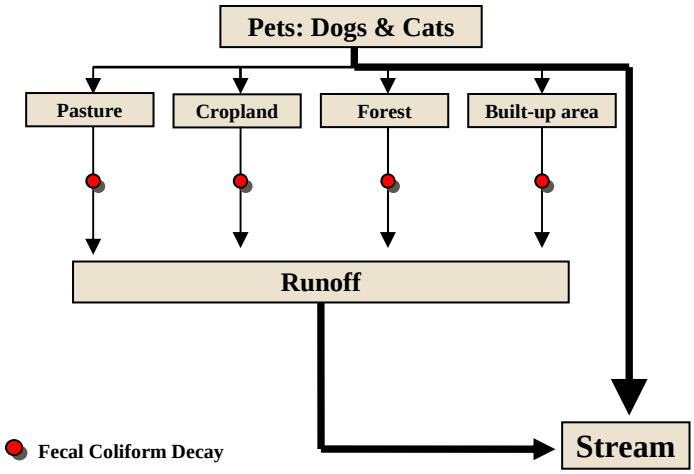
Category	Permit Type	Count (Active or Application)
VPDES	Industrial	4
	Municipal	9
General Permits	Single Family Domestic Sewage	2
	Car Wash	1
	Concrete	3
	Construction Stormwater	48
	Industrial Stormwater	19
	Petroleum	3
	Mining	1
	VPA*	1
	Poultry	1
MS4 Permits	Individual MS4 Permits	5
Total		**97**

*Permits are issued for animal feeding operations with 300 or more animal units

5.2 Fecal Coliform loading from Pet Sources

Pet Estimates:

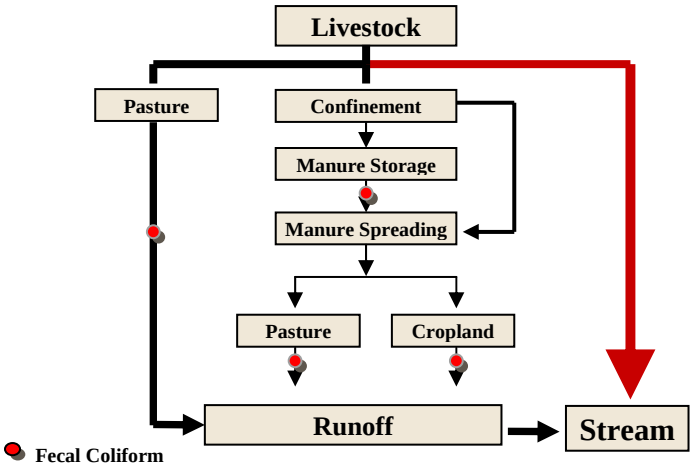
- Pet inventories based on:
  - 0.543 Dogs per household*
  - 0.598 Cats per household*
- In the study area there are approximately:
  - **19,876** Dogs
  - **21,706** Cats



Pet Estimates by Impairment Watershed:

Impairment Watershed	Cats	Dogs
Beaver Creek	237	217
Meadow Creek	5,253	4,810
Mechums River	1,438	1,317
NF Rivanna	3,999	3,662
Preddy Creek	758	694
Rivanna Mainstem	17,127	15,682

5.3 Fecal Coliform loading from Livestock



Livestock Estimates within the Study Area:

Livestock Type	Albemarle	Greene	Nelson	Orange	Total
Beef cows	6,208	2,600	1	137	8,946
Milk cows	328	248	0	20	596
Hogs and pigs inventory	52	0	0	3	55
Sheep and lambs inventory	1,154	165	0	6	1,325
Chickens	568	179	0	11	758
Horses and ponies, inventory	3,583	0	0	27	3,610

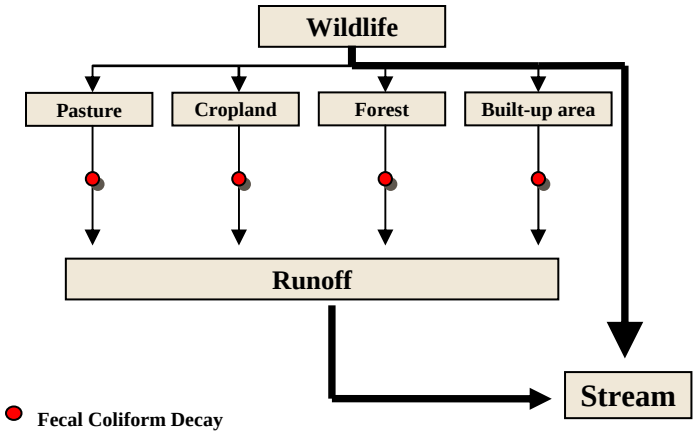
*Livestock numbers are based on the 2002 US Agricultural Census data and the horse numbers were based on the 2001 VA Agricultural Statistics Equine report.

Livestock Estimates by Impairment Watershed:

Livestock Animal	Beaver Creek	Meadow Creek	Mechums River	NF Rivanna	Preddy Creek	Rivanna Mainstem
Beef Cows	285	13	957	3,980	685	8,575
Milk Cows	15	1	51	326	57	568
Hogs & Pigs	2	0	8	14	5	52
Sheep & Lambs	53	2	178	424	83	1,278
Chickens	26	1	87	308	57	728
Horses & Ponies	164	7	552	843	224	3,495

*Livestock numbers are based on the 2002 US Agricultural Census data and the horse numbers were based on the 2001 VA Agricultural Statistics Equine report.

5.4 Fecal Coliform loading from Wildlife



Wildlife Estimates within the Study Area:

Wildlife Animal	Albemarle	Charlottesville	Greene	Nelson	Orange	Total
Deer	14,859	306	2,799	18	217	18,199
Raccoon	10,603	118	2,403	3	195	13,322
Muskrat	45,819	512	10,384	11	842	57,569
Beaver	4,998	56	1,133	1	92	6,280
Goose	1,265	26	238	2	18	1,549
Mallard	33	0	8	0	1	42
Wood duck	30	0	7	0	1	38
Wild Turkey	3,162	65	596	4	46	3,872

*Estimates are based on NLCD 2001 land use data and distribution estimates from DGIF

Wildlife Estimates by Impairment Watershed:

Wildlife Animal	Beaver Creek	Meadow Creek	Mechums River	NF Rivanna	Preddy Creek	Rivanna Mainstem
Deer	287	271	1,781	5,464	1,139	14,026
Raccoon	265	176	1,477	4,486	1,005	11,430
Muskrat	1,147	760	6,384	19,384	4,341	49,393
Beaver	125	83	696	2,115	474	5,388
Goose	24	23	152	465	97	1,194
Mallard	1	1	5	14	3	36
Wood Duck	1	0	4	13	3	32
Wild Turkey	61	58	379	1,163	242	2,984

*Estimates are based on NLCD 2001 land use data and distribution estimates from DGIF

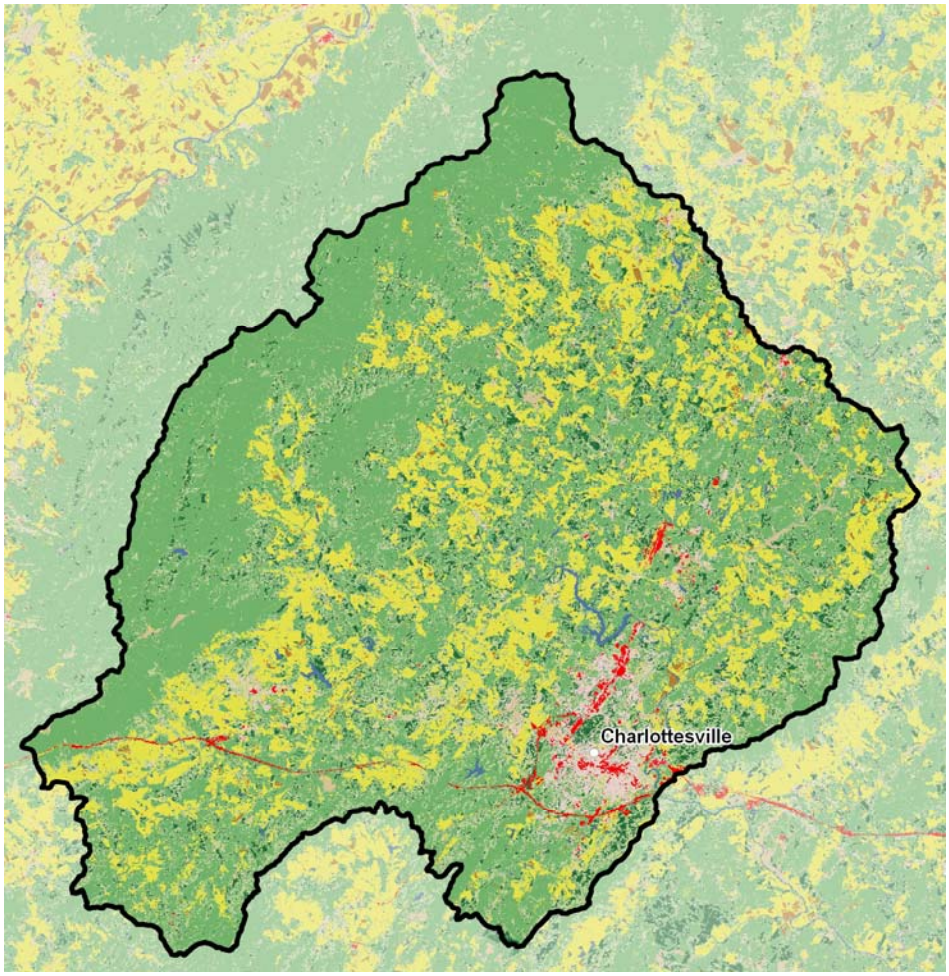
Discussion Questions:

1. Do these numbers seem reasonable to you?

2. Are there any suggestions you would make?

3. Are there any sources that you would suggest to include?

6. Land Use Data



Land Cover Type	Water/ Wetlands	Developed	Agriculture	Forest	Grassland/ Shrub	Barren	Total
Rivanna River Watershed							
Acres	2,602	39,413	68,798	209,025	8	2,602	39,413
Percent Area	1%	12%	22%	65%	<1%	1%	100%

Discussion Questions:

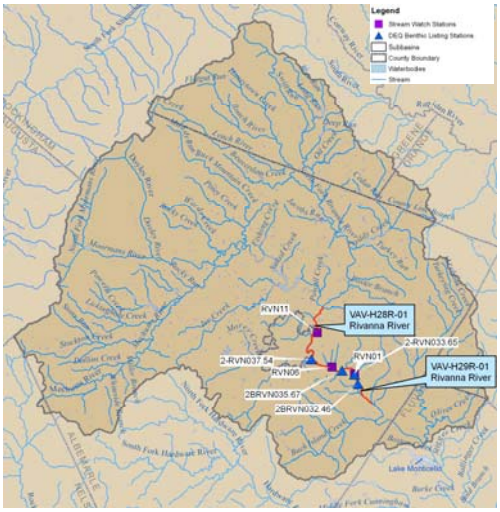
How is land use in your community changing and how could these changes potentially affect the bacteria levels in streams?

7. Next Steps for Bacteria TMDL

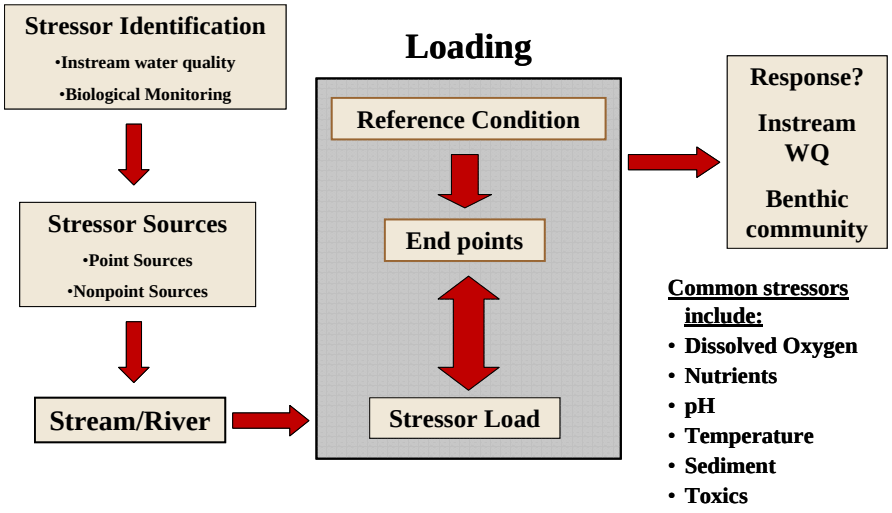
- Finalize Source Assessment
- Calibrate and validate hydrology and water quality model
- Develop Draft TMDL allocations
- Draft TMDL Report

Benthic TMDL Development

- Based on Biological Monitoring, 2 segments in the Rivanna River Watershed are impaired at DEQ stations 2-RVN033.65 (sampled in 2005) and 2-RVN035.67 (sampled in 2002) and StreamWatch Stations RVN01 (sampled in 2002-2006), RVN06 (sampled in 2003), RNV11 (sampled in 2002-2006).
  - Assessments indicate the benthic community is impaired.
  - Therefore, the listed segments do not meet the Aquatic Life Use support goal.
  - The General Water Quality Standard: "All state waters shall be free from substances […] which are harmful to human, animal, plant or aquatic life." (9 VAC 25-260-20).



Benthic TMDL Development Process:



Data Used in Stressor Identification:

1. Biological and Habitat Assessment Data: DEQ, StreamWatch Community Monitoring
   a. Biologists field notes and observations
2. Water Quality Data: DEQ
   a. Instream water quality data
3. Toxicity Testing: DEQ
   a. Acute toxicity testing
   b. Chronic toxicity testing
4. Discharge Monitoring Reports (DMR)

Stressor Identification Process:

- Each candidate stressor was evaluated based on available monitoring data, field observations, and consideration of potential sources in the watershed
- Potential stressors were further classified as:
  - **Non-stressors:** The stressors with data indicating normal conditions and without water quality standard violations, or without any apparent impact
  - **Possible stressors:** The stressors with data indicating possible links, however, with inconclusive data to show direct impact on the benthic community
  - **Most probable stressors:** The stressors with the conclusive data linking them to the poorer benthic community

Preliminary Stressor Identification Summary:

Non-Stressors
Temperature and pH
Dissolved oxygen
Instream metals
Organic and metal contaminants in river sediments
Possible Stressors
Phosphorus
Toxicity
Most Probable Stressors
Sediment/ Urban Runoff

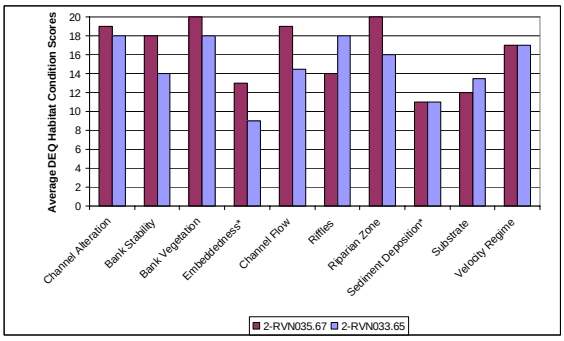
- **Non-Stressors:**
  - *Temperature:* Field measurements indicated that adequate temperature values were recorded on the biologically impaired segments**.**
  - *pH***:** All recent pH measurements showed a suitable range for benthic invertebrates
  - *Dissolved oxygen:* The field dissolved oxygen samples and the diurnal monitoring samples both complied with the dissolved oxygen standards.
  - *Instream metals:* The instream heavy metals data (including aluminum, antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc) were below the acute or chronic dissolved freshwater criteria specified in Virginia's aquatic life use standards.
  - *Organic and metal contaminants in river sediment*s: All samples were below the detection limits.

Therefore, temperature, pH, dissolved oxygen, instream metals, and organic and metal contaminants in river sediments do not appear to be adversely impacting benthic communities in Rivanna River and are classified as non-stressors.

- **Possible stressors:**
  - *Phosphorus:* Benthic macroinvertebrate sampling indicated that majority of samples are composed of macroinvertebrates which are typically tolerant to pollution from organic wastes or nutrients. However,
    - The diurnal dissolved oxygen fluctuation is indicative of a healthy system with no dissolved oxygen standard violations
    - The Moores Creek STP is considered to be the primary cause of the increase of phosphorus within the impaired segment. By 2010, this plant will be upgrading to remove nutrients to comply with the new state regulations on nitrogen and phosphorus loadings to the Chesapeake Bay.
  - *Toxicity:* Acute and chronic toxicity testing was conducted twice along the impaired segment.
    - These tests showed that there was not a toxic effect of the *Ceriodaphnia dubia*, also known as water fleas, for both surveys.
    - There was a biological effect on fathead minnow survival and biomass.
    - These toxicity tests do not provide information on the source of the toxics that may be affecting the fish community.
    - During both sampling periods of the toxicity tests, there were major storm events which may affect the results.

Therefore, phosphorus and toxicity are considered to be possibly impacting the biological community in the Rivanna River.

- **Most Probable Stressors:**
  - *Sedimentation and Urban Runoff:* Sedimentation and urban runoff have been identified as most probable stressor in the Rivanna River benthic impaired segments based on the composition of the benthic community, and benthic habitat data from the impaired stations.
    - In particular, embeddedness and sediment deposition habitat scores at the impaired stations were suboptimal.



    - The impervious surfaces within the urban areas will increase the speed of runoff which can erode banks, scour stream beds, and deliver toxic chemicals. Also, in the upper portion of the watershed, studies have shown that there is a high level of sedimentation related to stream bank instability.
    - Urban runoff can contribute sediment containing toxic chemicals in the water column and nutrients from land areas to the stream. The toxicity studies indicated that there was a toxic effect on fathead minnows. However, the source of the toxicity has not been identified. These observations indicate that urban runoff may be affecting the benthic community.

Therefore, sedimentation and urban runoff are considered to be the most probable stressors impacting the biological community in the Rivanna River.

Benthic TMDL Next Steps:

- Finalize stressor identification report
- Select technical approach
- Develop the TMDL Allocation Scenarios.

Questions:

1. Do these conclusions seem reasonable and fit your knowledge of the watershed?

2. Are there any other potential stressors for which data are available and should be considered?